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Inside this Issue

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AQUATIC RESOURCES NEWS

A REGULATORY NEWSLETTER

Headquarters, U.S. Army Corps of Engineers, Regulatory Branch

A Note from Headquarters

Most regulators do not have the opportunity to see aquatic resources in other parts of the country from those in which they work. Therefore, we plan to periodically issue newsletters that describe and show specific types of waters of the U.S., comparing and contrasting the physical, chemical and biological characteristics of these waters in different parts of the country. In the next issue, we've asked District experts to describe wetlands found in different mountain ranges such as the Rockies, Ozarks and Cascades, among others. I hope you find these descriptions of interest and glean an understanding of the regional differences within one type of aquatic resource. In addition, I hope that we can present these descriptions in a way so that you can get an appreciation of the difficulty of providing regulations and/or guidance that addresses these differences at the national level.

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A Note from the Editor

This issue focuses upon on a watershed approach to making compensatory mitigation decisions. The National Research Council (NCR) Report, *Compensating for Wetland Losses Under the Clean Water Act* (2001), stated that site selection for wetland mitigation should be conducted on a watershed scale in order to maintain wetland diversity, connectivity, and appropriate proportions of upland and wetland systems needed to enhance the long-term stability of the wetland and riparian systems. A year later, Regulatory Guidance Letter 02-2 called for districts to "use watershed and ecosystem approaches when determining the resource needs of the watershed, where impacts will occur, and also consider the resource needs of neighboring watersheds.

The Federal Mitigation Action Plan (MAP), released at the same time as the Regulatory Guidance Letter, called for follow-up guidance for integrating compensatory mitigation into a watershed context to implement the NRC recommendations (See the Current Events Section on page 14 of this newsletter for an update of the MAP). The MAP called for analyzing the use of compensatory mitigation within a watershed context and identification of criteria for making compensatory mitigation decisions in this context by 2005. The objective would be to "develop guidance to encourage placement of mitigation where it would have the greatest benefit and probability for long-term sustainability." The guidance would help decision-makers utilize the watershed-based planning tools and resources already developed. It should be noted that NRC was concerned about the impracticality of implementation of their watershed recommendations (see Aquatic Resources Newsletter Vol. 1, Issue 2, Winter 2002, for a discussion of the NRC recommendations). The NRC did not equate a watershed approach with a watershed plan, rather recognized that decisions should consider a structured consideration of watershed needs through collaboration with others and integration with other regulatory as well as non-regulatory land management programs.

Distribution of Aquatic Resources News

The *Aquatic Resources News* will be distributed to field staff by e-mail. The Newsletter will also be available on the IWR website within the month at: http://www.iwr.usace.army.mil/iwr/regulatory/regulintro.htm
You may contact the Editor, Bob Brumbaugh, CEIWR-GR at (703) 428-7069 or Robert.w.brumbaugh@usace.army.mil. HQ point-of-contact for the newsletter is Katherine Trott, CECW-LRD (202) 761-5542 Katherine.l.trott@usace.army.mil

To help the MAP interagency workgroup towards developing watershed guidance, the Environmental Law Institute facilitated the "National Symposium on Compensatory Mitigation and the Watershed Approach" in Washington, DC on May 19-21, 2004. The forum was structured to provide the MAP workgroup with direction and input. The Forum brought together the workgroup to hear from Federal and state government staff, non-government researchers, and academic scientists doing watershed planning or tool development. The symposium presentations, discussions, and background readings can be found at: http://www.eli.org/research/watershedsymposium.htm. The MAP workgroup learned of many watershed-based efforts including agency-directed watershed planning efforts and watershed assessment and prioritization tools. This newsletter presents three of those efforts. The first article discusses an assessment tool being developed as part of a series of Special Area Management Plans in southern California, which are Federally authorized studies partially funded by the Federal government. The other two articles focus on state-wide efforts led by state agencies with varying involvement by the Corps.

Assessing Riparian Ecosystem Integrity, Analyzing Alternative Development Scenarios, and Planning for Restoration in a Watershed Context

Smith, R. D. and F. Tabatabai

Introduction

The Los Angeles District Corps of Engineers is developing a Special Area Management Plan (SAMP) for five watersheds in three southern California counties (Figure 1). Criteria for conducting a SAMP include a sensitive geographic area experiencing strong development pressure, active interagency, stakeholder, and public involvement, and development of a definitive regulatory product (See Corps of Engineers Regulatory Guidance Letter RGL 86-10). Southern California meets all these criteria. It is home to a large number of Federal listed, threatened or endangered species (twenty-seven in Orange County), is one of the fastest growing areas in the nation and is experiencing strong development pressure. In the early 1990's, local agencies and landowners in this region undertook planning efforts aimed at conserving habitat for a handful of Federally and state listed species, which resulted in conservation of 58 square miles of natural reserves. However, this planning effort did not consider aquatic resources and development activities that were compelled to avoid habitat for listed species (upland areas) began to encroach into the aquatic resources.

In 1998, the House of Representative's Public Works Committee authorized the Los Angeles District to initiate a SAMP in Orange, Riverside and San Diego Counties. Specific objectives were to complement ongoing habitat conservation planning efforts, allow a comprehensive approach to management of uplands and aquatic resources, streamline and provide better scientific information for decision making under the Section 404 regulatory process, and provide local citizens with a greater level of regulatory predictability.

In support of the SAMP, the Engineer Research and Development Center (ERDC) developed methods based on watershed management principles to identify aquatic resources, assess riparian ecosystem integrity, analyze alternative development scenarios, and plan for the restoration of riparian ecosystems. This article provides an overview of these methods and uses the San Diego Creek Watershed SAMP as an example to demonstrate the application of these methods.

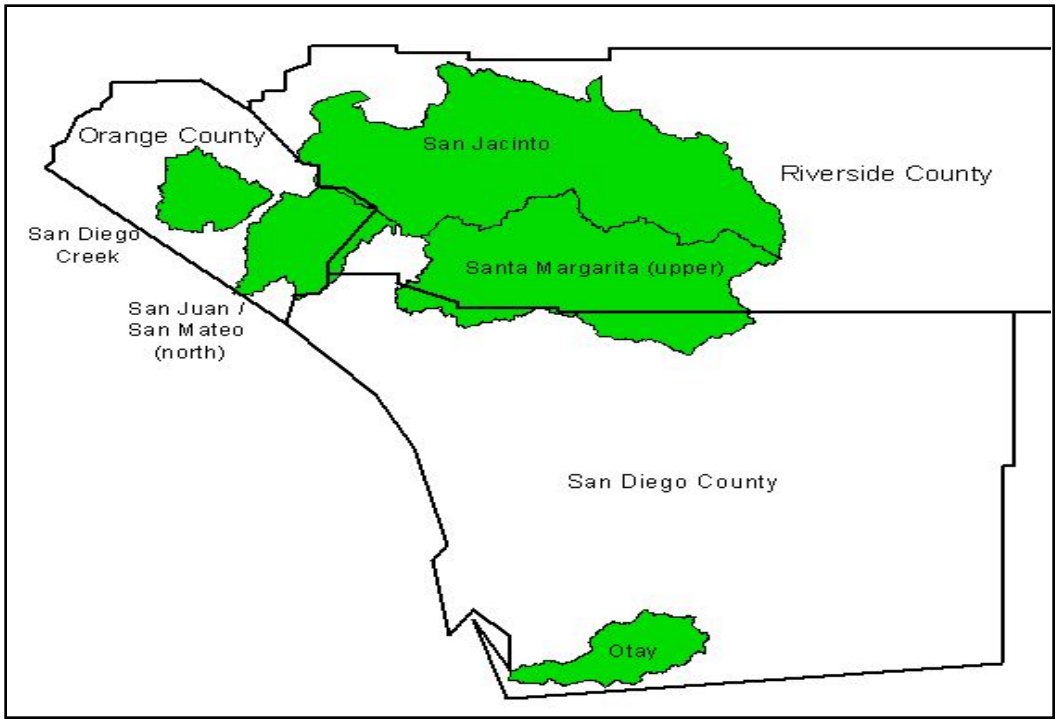

Figure 1. Location of southern California SAMP watersheds

Study Area

The San Diego Creek watershed is part of the extensive urban corridor that occupies much of the coastal plain in Orange County south of Los Angeles (Figure 2). Land use in the San Diego Creek watershed consists primarily of residential, commercial, and light industrial developments mixed with remnant agricultural operations, plant nurseries, military facilities, and transportation.

The San Diego Creek watershed is in the California Chaparral Forest and Shrub Ecoregion. Ephemeral and intermittent streams predominate with headwaters originating in the Santa Ana Mountains and San Joaquin Hills, and streams draining generally in a westerly direction towards Newport Bay. Vegetation distribution is strongly influenced by topographic and climatic factors. Along the coast, sand dune communities occur near the beaches, and salt marshes behind natural beach barrier ridges. Drier areas along the coast support the coastal sage scrub community and non-native grasslands. Further inland, alluvial valleys support riparian communities, with grasslands, sclerophyllous oak woodlands, coastal sage scrub and chaparral occurring along localized moisture/elevation gradients.

Methods

Four procedures were developed to assist in managing riparian ecosystems in the San Diego Creek watershed. The first procedure was designed to identify all aquatic resources in the watershed. The last three procedures were developed for managing riparian ecosystems, the predominant subset of the aquatic resources in the watershed. These three procedures included: 1) assessing baseline riparian ecosystem integrity; 2) assessing potential impacts of alternative development scenarios to riparian ecosystems and 3) and developing a watershed restoration plan for riparian ecosystems.

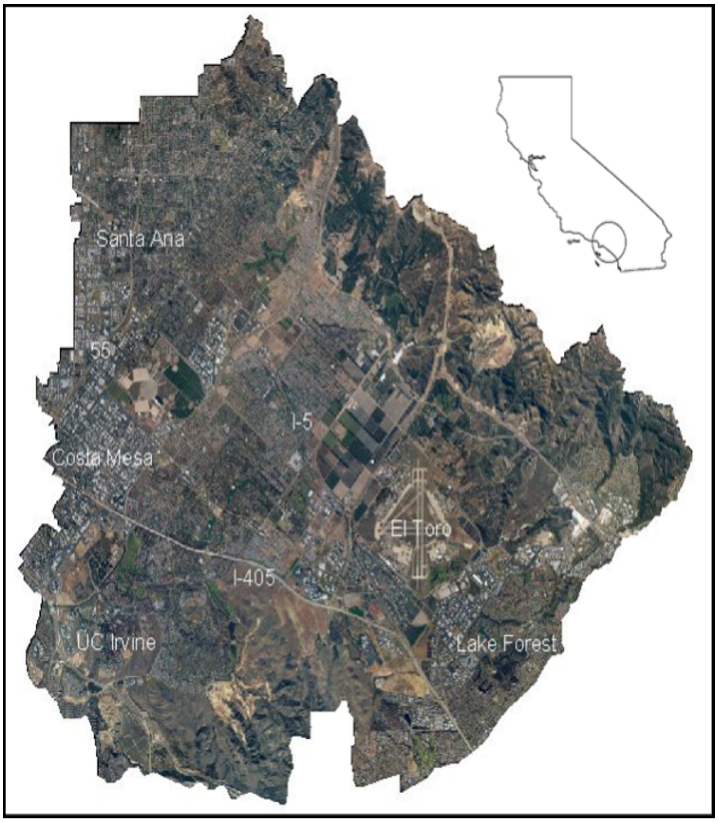

Figure 2. San Diego Creek watershed, Orange County, California

(1) Identification of Aquatic Resources

The location and extent of aquatic resources throughout the watershed were identified using a watershed scale "delineation" procedure developed by Lichvar (2000). Geomorphic surfaces (i.e., bankfull channel, floodplain, terrace, depression, slope, etc.) and vegetation communities were identified along stream channels using aerial photography, and incorporated into a geographic information system (GIS). Correlations between vegetation types, hydrologic regimes (based on field indicators), and geomorphic surfaces were developed. Probability of jurisdiction was assigned to combinations of mapped geomorphic surfaces and vegetation community polygons (Figure 3).

(2) Assessing Riparian Ecosystem Integrity

A "baseline" assessment of hydrologic, water quality, and habitat integrity of riparian ecosystems in the San Diego Creek watershed under current conditions was conducted. Assessing all riparian ecosystems in the watershed using a single, comparable assessment procedure was essential for developing the watershed management plan for riparian ecosystems.

(a) Identification and Characterization of Riparian Ecosystem Reaches. Riparian ecosystems were defined as the areas along perennial, intermittent, and ephemeral streams where the interaction with surface and groundwater results in distinctive geomorphic features and vegetation communities. The riparian ecosystem includes the bankfull stream channel, active floodplain, and terraces (i.e., historical floodplains). Riparian ecosystems typically included all aquatic resources regulated under the 404 Program and California Department of Fish and Game (CDFG) 1600 Program, but also included areas that do not fall under the jurisdiction of one or both of these programs.

An assessment unit or "riparian reach" was defined as a segment of stream channel and the adjacent riparian ecosystem with relatively homogenous geology, geomorphology, soils, hydrologic regime, channel morphology, vegetation, and cultural alteration. Preliminary riparian reaches were identified using field reconnaissance, aerial photographs, and topographic maps, and then digitized as polygons in a GIS based on the aquatic resource map developed by Lichvar (2000).

A main stem channel, main stem tributaries, local drainage area, drainage basin were associated with each riparian reach (Figure 4). The drainage basin included the local drainage of a riparian reach as well as local drainages of all upstream riparian reaches.

Riparian reaches were characterized in the field. A representative portion of the riparian reach was selected for collecting characterization (Table 1) and indicator data (Table 2).

(b) Indicators of Riparian Ecosystem Reaches characteristics & processes. Indices of hydrologic, water quality, and habitat integrity consisted of a suite of indicators designed to capture the range of characteristics and processes that influence hydrology,

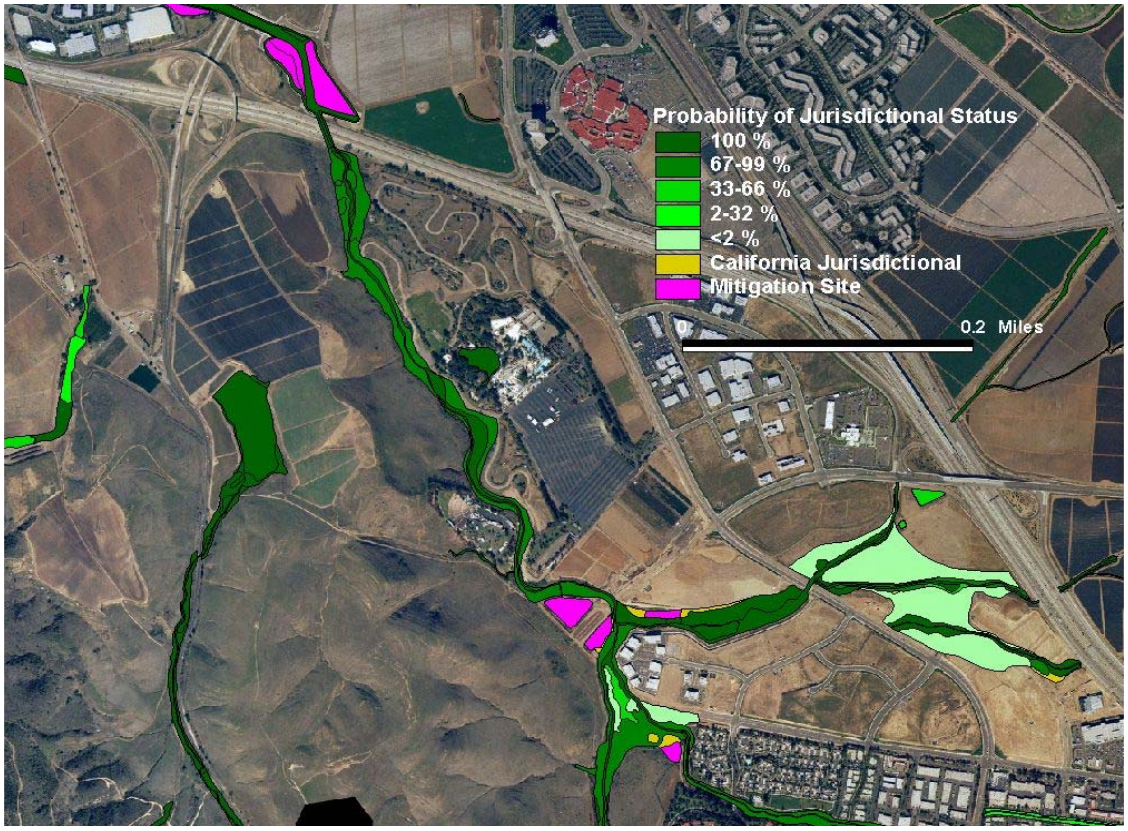

Figure 3. Mapped aquatic resources with associated probability of jurisdiction

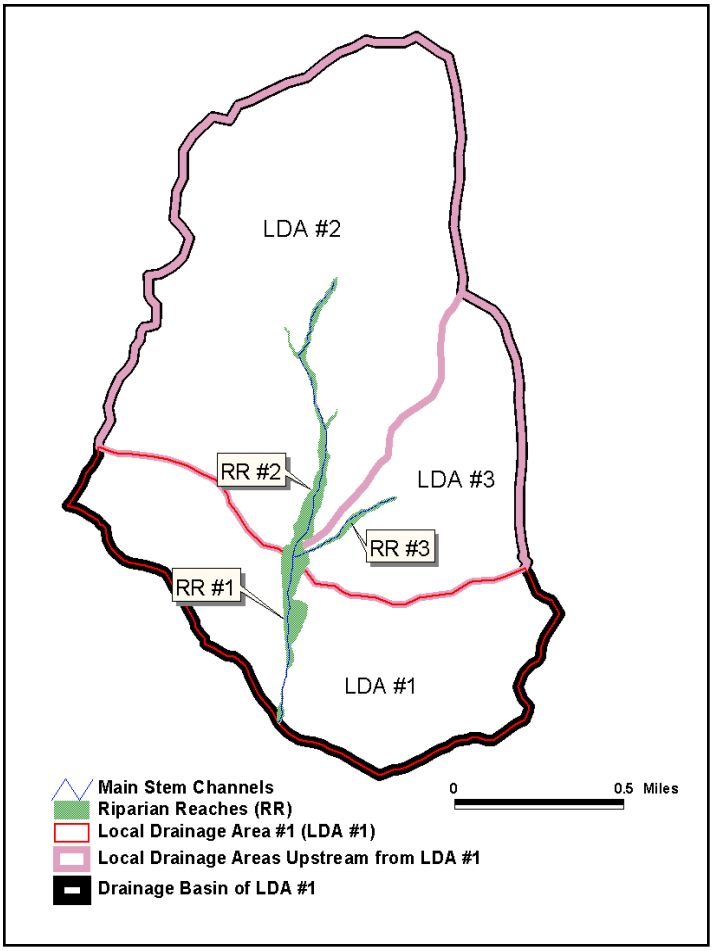

Figure 4. Illustration of riparian reach, main stem channel, local drainage, and drainage basin

water quality, and habitat integrity of riparian ecosystems at several spatial scales. Potential indicators were gleaned from a review of existing assessment methods, riparian ecosystem literature, field observations, and the experience of individuals participating in the project. Table 2 lists some of the indicators and their use in integrity indices. Detailed descriptions of indicators, definitions, metrics, reference conditions and scaling procedures are available in several reports (Smith 2000, 2004).

Several factors influenced the selection of indicators. First, the requirement to develop a procedure that could assess riparian ecosystem integrity for a large number of riparian areas within a watershed with limited time and resources, and estimate cumulative and potential future impacts. Second, the need to develop an easily understood process that allowed participation and input from multiple stakeholders representing a range of perspectives and interests.

(c) Calculation of Integrity Indices. Indicator values were determined in the field as a percent deviation from reference condition (i.e., 0-100). For example, the Improved Hydraulic Conveyance - Riparian Reach indicator was the percent of the main stem channel that had been modified (e.g. channelized) to improve hydraulic conveyance. Indicator values were converted to scores ranging from 1-5 based on a relationship between indicator values and scores. A score of 5 represented close concurrence with the reference condition (i.e., culturally unaltered) and a high level of integrity. A score of 1 represented a deviation of 50% or more from the reference condition and a low level of integrity.

Composite hydrologic, water quality, and habitat integrity indices

Table 1. Some Riparian Reach Characterization Variables

Riparian Reach Characterization Variables	Source/ Method
Area of Riparian Ecosystem in Riparian Reach	GIS
Length of Main Stem Channel in Riparian Reach	GIS
Drainage Basin Area	GIS
Length of Main Stems & Main Stem Tributaries in Drainage	GIS
Valley Length, width, slope	Field / GIS
Stream Channel Type (Rosgen)	Field
Drainage Density	Calculated
Channel Slope	Calculated
Sinuosity	Calculated
Bankfull Width, Maximum & Mean Depth	Field
Width / Depth Ratio & Bankfull Cross-Sectional Area	Calculated
Entrenchment Ratio	Calculated
Channel Substrate Bedrock / Boulder, cobble, gravel, etc. (%)	Field
Geomorphic Zone	Field
Riparian Ecosystem Condition Index	Field
Restoration Template	Field
Restoration Level of Effort	Field
Dominant Vegetation Species on Floodplain, bankfull	Field

Table 2. Some selected Indicators used for calculation of integrity indices

#	Indicators	Hydrologic	Water	Habitat
1	Improved Hydraulic Conveyance -	X	X	
2	Improved Hydraulic Conveyance -	X	X	
3	Perennialized Stream Flow	X	X	
4	Floodplain Interaction	X	X	
5	Surface Water Retention	X	X	
6	Imperviousness - Local Drainage	X	X	
7	Sediment Regime Index - Riparian		X	
8	Exotic Plant Species - Riparian			X
9	Riparian Vegetation Condition -		X	X
10	Riparian Corridor Continuity -			X
11	Riparian Buffer			X

were calculated by combining indicators. For instance, the habitat integrity index entailed combining indicators for riparian corridor connectivity, wildlife habitat, and buffer alterations.

3) Assessing Potential Impacts of Alternative Development Scenarios

Potential impacts of proposed development scenarios were assessed for a variety of criteria including riparian ecosystem integrity. Alternative development scenarios were proposed for the San Diego Creek watershed (Figure 5), including a "resource based" scenario developed by the Los Angeles District (Figure 6). The baseline assessment of riparian ecosystem integrity provided the platform for analyzing and comparing the potential impacts of proposed alternative development scenarios.

Some of the development scenarios were analyzed by using the GIS to pair the spatial extent of each resource criterion theme (aquatic resources, non wetland aquatic resources, suitable habitat for listed and sensitive species, etc.) with the direct impact footprint of the proposed development scenario to determine the resource impacts. Complete descriptions of all resource criteria can be found in Smith (2004).

Other scenarios compared the integrity of riparian reaches under baseline conditions to their integrity following implementation of future development scenarios. The post-project conditions that were likely to exist after implementing an alternative development scenario were simulated by overlaying the alternative development scenario impact footprint (Figure 5) onto the baseline condition maps in the GIS.

4) Planning for Riparian Ecosystem Restoration.

The goals in developing a watershed restoration plan for riparian ecosystems in the San Diego Creek watershed were to: 1) Identify an appropriate "restoration template" for each riparian reach based on current conditions, and provide general specifications for geomorphic surface dimensions, dominant vegetation, and other restoration factors for each of the templates; and 2) Develop a method for identifying where restoration efforts should be focused in the watershed given specific restoration objectives. The baseline assessment provided the platform for achieving these goals.

We began by classifying each riparian reach in terms of "Geomorphic Zone" (geomorphic characteristics under "equilibrium" conditions); "Restoration Template" (the extent to which the equilibrium condition could be re-established); and the "Level of Effort" necessary to achieve the Restoration Template conditions.

Geomorphic Zones

In the San Diego Creek watershed five Geomorphic Zones were identified based on field investigations, topographic maps, maps and descriptions in the county soil survey, and geologic maps and reports for the region.

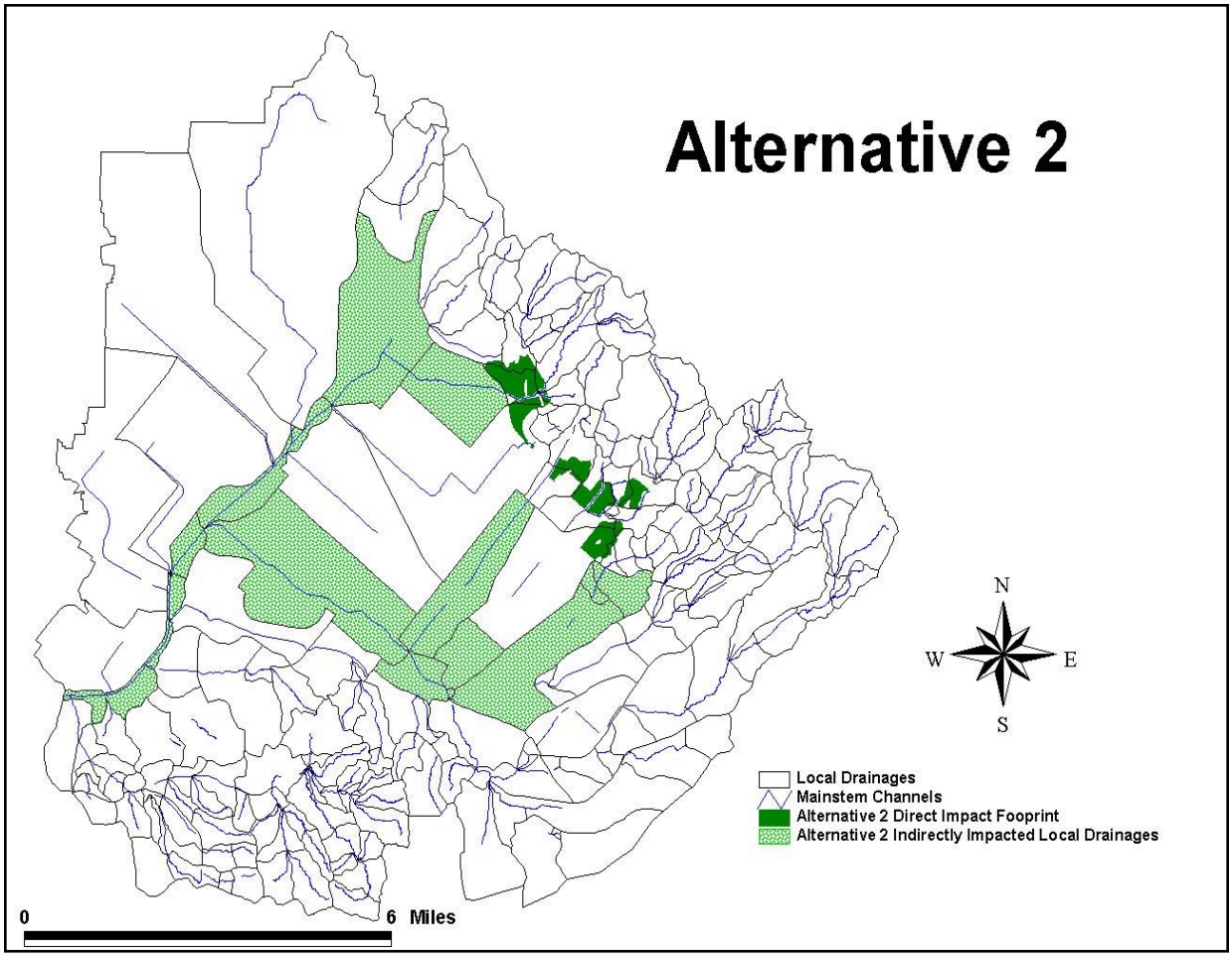

Figure 5. Illustration of an alternative development scenario direct impact footprint and indirectly impacted local drainages.

Restoration Templates

We developed Restoration Templates for riparian ecosystems in various states of cultural alteration. In the San Diego Creek watershed, the six Restoration Templates included: 1) natural, 2) incised, 3) constrained, 4) aggraded, 5) engineered, and 6) impractical. We used data collected during the baseline assessment to determine restoration specifications for bankfull channel, floodplain, and terrace morphology and dimension, and dominant vegetation types. Using aerial photography, baseline assessment data, and our knowledge of each riparian reach, we assigned a Restoration Template to each reach based on the current condition of the channel, riparian vegetation, and surrounding land uses. The Restoration Template was intended to represent the best possible restoration target. The objective is to re-establish all of the vegetation zones present under relatively natural conditions and in relative proportions corresponding to the extent of the geomorphic surfaces found in relatively intact reference reaches.

The Restoration Templates were intended to determine the feasibility of restoring individual reaches, and to prioritize restoration actions based on expected functional benefits. Although we expect that final restoration designs will resemble these templates and associated relative dimensions, site-specific restoration designs will have to be developed that include grading plans, planting stock, planting densities, irrigation practices, and similar requirements.

Level of Effort

We also developed a scale for estimating the level of effort required to restore a riparian reach to the prescribed Restoration Template. The Level of Effort measure was intended as a tool for planners based on the assumption that there would be limited resources and sites available for restoration and that cost is a factor. Thus, the Level of Effort scale is a crude estimate of restoration costs, but exactly how much more can only be determined on a case-by-case basis. This does not consider real estate costs or similar issues included in these estimates, and unforeseen issues could change the estimates dramatically.

Restoration Simulations

Baseline assessment integrity indices were compared to post-restoration integrity indices to identify which riparian reaches would best satisfy the objectives of a specific restoration scenario.

We also explored the possibility of restoration efforts beyond the riparian ecosystem by simulating changes in hydrologic, water quality, and habitat integrity that result from upland restoration (i.e., at the local drainage and drainage basin scale). The objective was to identify the riparian reaches where application of the Restoration Template as well as restoration of altered uplands to native vegetation would result in a substantial increase in riparian

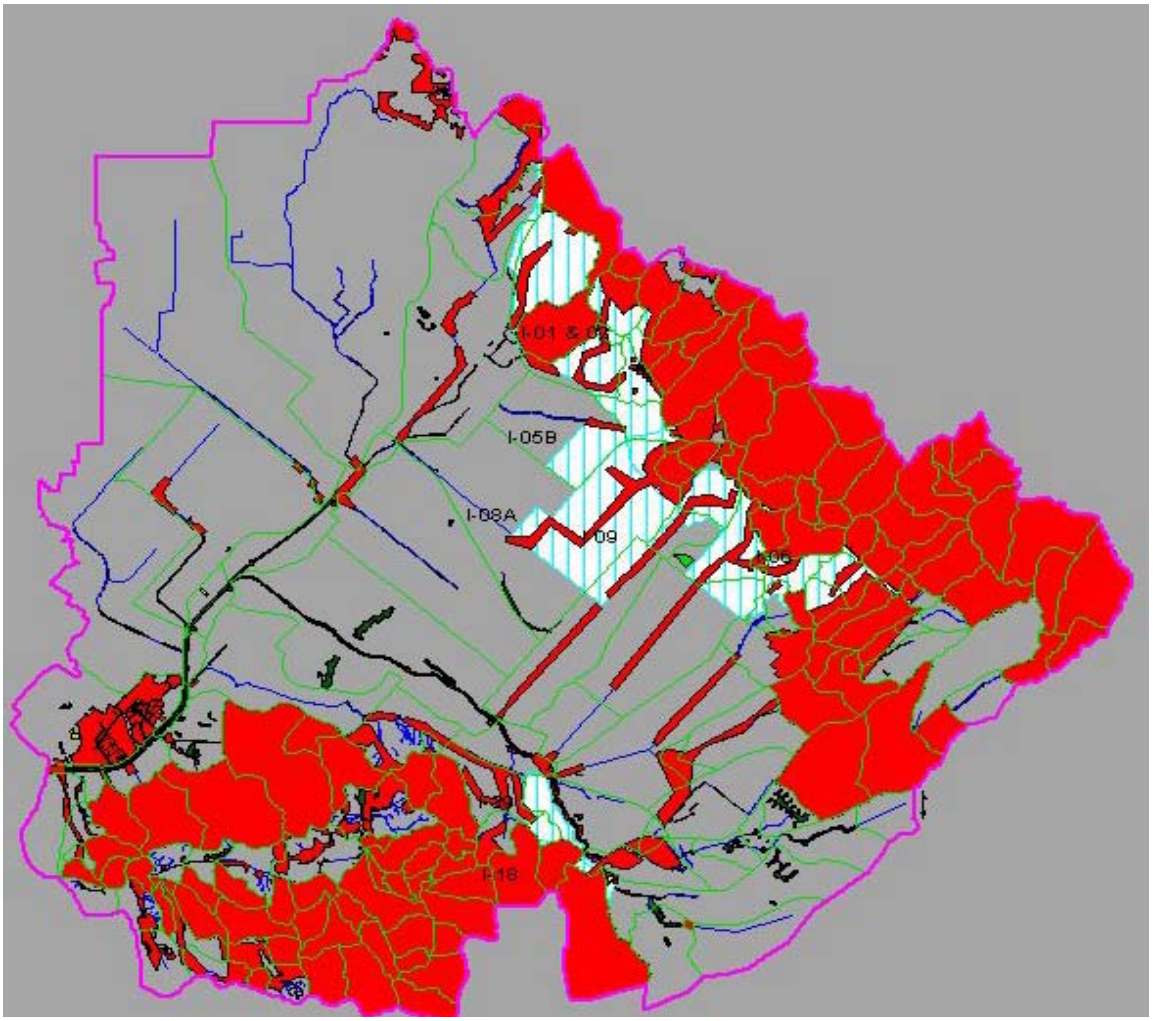

Figure 6. Avoidance area (in red) under proposed resource based alternative.

ecosystem integrity. Under these simulations, changes in the indicator values for land use and other local drainage and drainage basin indicators often resulted in increased integrity indices for riparian reaches downstream of the upland restoration locations.

Results and Discussion

(1) Baseline Assessment: San Diego Creek Watershed

Almost two hundred riparian reaches were identified in the San Diego Creek watershed. The area of riparian ecosystem in riparian reaches ranged from < 1 to 72 acres with a mean of 4.8 acres, and the length of the main stem channel in riparian reaches ranged from 460 to 4800 feet with a mean length of 3600 feet.

The hydrologic, water quality, and habitat integrity indices for riparian ecosystems that result from the baseline assessment have a variety of uses. Integrity indices are scaled to a culturally unaltered reference condition and provide a relative estimate of cumulative impacts that have occurred in both individual riparian reaches and the entire watershed prior to the time of the baseline assessment. Baseline integrity indices provide a mechanism for estimating cumulative impacts that occur after the baseline assessment. Knowing the location, extent, and integrity of all riparian ecosystems in the watershed is useful in processing permit applications and developing general permits requirements for the watershed. It also makes it possible to make informed decisions on what areas of the watershed should be avoided, which proposed alternatives will have the least impact, and where restoration efforts should be focused.

(2) Analyzing Alternative Development Scenarios: San Diego Creek Watershed

Five alternative development scenarios were proposed in the San Diego Creek watershed. We compared alternative development scenarios in terms of the degree to which they impacted non-wetland waters, main stem stream channels, aquatic resources, riparian ecosystems, and designated critical habitat or potentially important habitat of threatened, endangered, or sensitive species. Although useful, these comparisons are relatively simplistic or incomplete, in that they ignore "qualitative" differences that exist between the criteria being measured. For example, when comparing the impacts of different alternatives on non-wetland waters, no distinction is made to distinguish between the condition of the non-wetland water as a result of disturbance or alteration. Thus, a highly altered, 200-foot segment of non-wetland waters and an undisturbed, 200-foot segment of non-wetland waters, are weighted equally. Similarly, wetland resources and riparian ecosystems of the same area, regardless of their degree of disturbance or alteration, are weighted equally.

We also evaluated quantitative and qualitative measures of how

different alternatives directly and indirectly impact riparian ecosystem through the use of integrity units (i.e., integrity index multiplied by area of riparian ecosystem). The integrity index of a riparian reach represents the quality of riparian ecosystems in the reach, while the area of riparian ecosystem in a riparian reach represents the quantity of riparian ecosystems in a reach.

A sample can provide a sense of the results from the analysis of alternative development scenarios. A complete analysis of the results can be found in Smith (2002). Table 3 shows miles of stream channels directly impacted by each alternative broken down by stream order. Column 8 shows the normalized rank score. The normalized rank score is the level of impact (i.e, miles of stream channel or acres of riparian ecosystem) for each alternative divided by the level of impact of the alternative with the greatest impact (26.1 miles in Table 3).

Stream channels are generally equally distributed throughout the watershed and therefore the total miles of stream channel impacted is a reflection of the size of the impact area of each alternative. Alternative 2 (Figure 5) with the smallest impact area (766 acres) had the fewest number of miles of stream impacted. Alternative 2 was intended to avoid all stream impacts. Alternative 4 had the largest impact area (4066 acres) and the greatest number of stream miles impacted.

Comparable analyses were conducted for other criteria like direct impacts to California Gnatcatcher Critical Habitat and changes to hydrologic integrity (see Smith [2004]). A comparison of these and the other criteria analyzed provides important information on which to base the management of riparian ecosystems in the watershed.

(3) Restoration of Riparian Ecosystems: San Diego Creek Watershed

One of the goals in developing a watershed restoration plan for riparian ecosystems in the San Diego Creek watershed was to identify the appropriate Restoration Template for each riparian reach based on current conditions, and provide general specifications related to the dimensions of geomorphic surfaces, vegetation, and other restoration factors. Figure 7 shows the Restoration Template assigned to each riparian reach, and Table 4 illustrates selected specifications for various features by Geomorphic Zone based on measurements from the least disturbed riparian reaches in the watershed.

The second goal was to identify where restoration efforts should be focused (i.e., which riparian reaches should be restored first) given a restoration scenario with specific objectives. The objective for the first restoration scenario was to prioritize riparian reaches in order to maximize the increase in riparian ecosystem integrity, regardless of the level of effort required.

The objective of the second restoration scenario was to prioritize riparian reaches to identify those reaches that would result in the greatest increase in riparian ecosystem integrity while factoring in the level of effort required. This scenario assumed that the resources available for the restoration effort are finite. A clear set of restoration objectives must be an important part in developing a watershed restoration plan for riparian ecosystems.

Watershed Approach to Development of Management Plans

In the baseline assessment of riparian ecosystems, the premise is that the integrity of riparian ecosystems is not based solely on characteristics and processes in the riparian ecosystem. It is essential to consider off-site factors that influence riparian ecosystem integrity such as land use in the drainage basin and alterations to upstream channels.

In order to manage riparian ecosystems in a watershed context, all riparian areas must be identified and analyzed in a similar fashion. This was done through the process of identifying aquatic resources, conducting the baseline assessment of integrity, analysis of alternative development scenarios, and developing a restoration plan for riparian ecosystems. All riparian ecosystems in the watershed are identified and assessed using the same suite of indicators and integrity indices, and the results represent a synoptic

Table 3. Criterion 1 - Length of non-wetland waters and main stem channels directly impacted.

Alternative	Length of Stream in Miles by Strahler Stream Order						Normalized Rank Score
	1st Order	2nd Order	3rd Order	4th Order	5th Order	Total	
2	0	0	0	0	0	0	0
3a	0.77	0.05	0.02	0.24	0.22	1.29	0.05
3b	0.53	0.04	0.01	0.24	0.21	1.03	0.04
4	13.79	3.88	2.82	2.58	3.04	26.11	1
5	12.23	2.96	2.26	1.72	1.78	20.95	0.8

Table 4. Selected specifications for features as measured in least-disturbed riparian reaches.

Feature	**Dimensions**	**Geomorphic Zone**				
		1	**2**	**3**	**4**	**5**
Bankfull Width (ft)	range	3-Jan	9-Jan	7-Feb	18-Apr	18-Oct
	average	2.5	4.4	4.6	10.7	13.8
Bankfull Mean Depth (in)	range	3-Feb	4-Jan	4-Mar	4-Feb	8-Apr
	average	2.5	4.1	3.5	2.7	5.5
Floodprone Width (ft)	range	4-Feb	8-Feb	5-Feb	Jun-40	20-25
	average	3	3.1	3.3	18.5	22.3

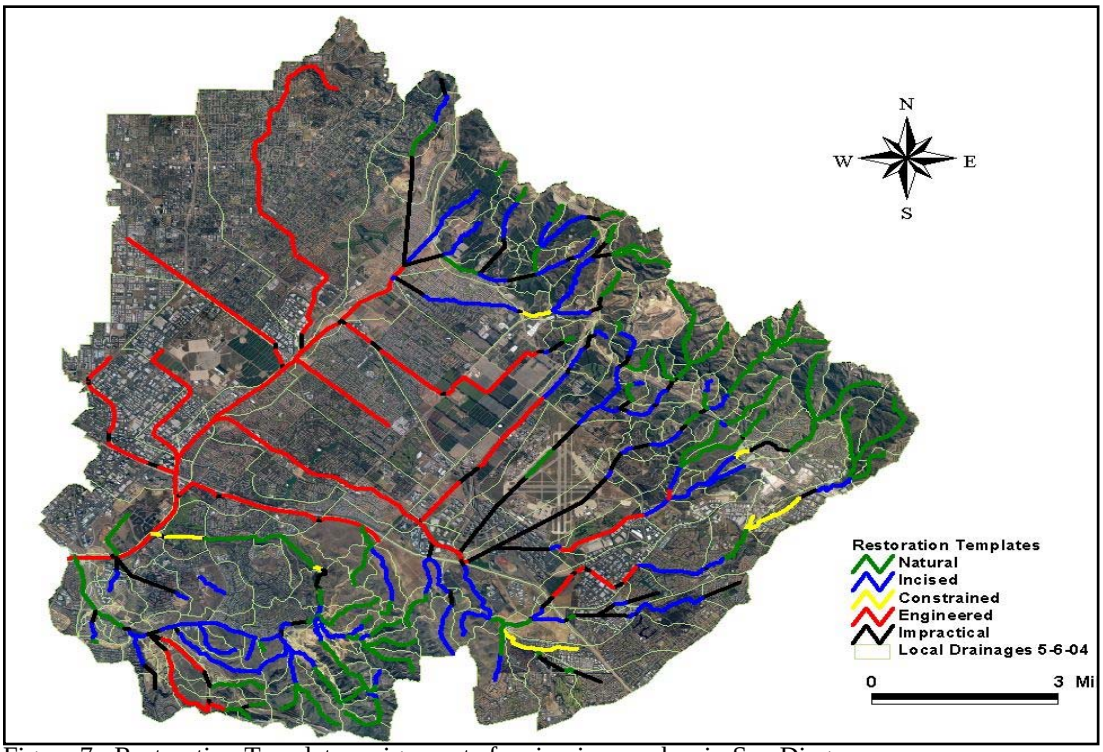

Figure 7. Restoration Template assignments for riparian reaches in San Diego

view of riparian ecosystems in the entire watershed. It is useful to know exactly where riparian areas are located in the watershed in relation to other riparian areas, what the extent and integrity of a riparian areas is compared to others the watershed, whether or not a riparian area is unique, rare, or supports threatened species, whether or not a riparian area is connected with other riparian areas, and how a riparian area compares to other riparian ecosystems in the watershed. This is information that can be used in permit decisions, avoidance of project impacts, location of conservation areas, and in managing riparian ecosystems in the watershed. Without synoptic watershed information about riparian ecosystems in an entire watershed, watershed management decisions are made without adequate information.

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(R. Daniel Smith is research ecologist with the Environmental laboratory of ERDC. His activities are focused on developing and applying methods for assessing the integrity of wetland and other aquatic resources from the site specific to the watershed scale. Fari Tababtabai was the SAMP Program Manager from the Los Angeles District before she assumed her current position as Chief, Environmental Planning Section, San Francisco District.

The North Carolina Approach to Compensatory Mitigation utilizing a Watershed-Based Approach

Scott McLendon

Beginning in the early 1990's, the State of North Carolina, Department of Transportation (NCDOT) embarked on an ambitious program of roadway improvements throughout the state in order to provide an adequate transportation infrastructure to accommodate increasing economic development and a growing population. It became apparent during the mid-1990's that as highway projects moved from the lengthy planning process within NCDOT to the construction phase where Section 404 permits were needed, that the frequency with which they were delayed was increasing. Beyond individual concerns over location and design, projects were also delayed due to the lack of adequate mitigation plans at the time permits were being sought to build roads. Although NCDOT was attempting to develop these plans in time to meet their letting schedule, the sheer number of projects coupled with the length of time needed to identify sites, develop plans, and allow for agency review invariably led to delays in the construction of these projects. In addition, this approach did not allow for a consideration of the required mitigation in the context of watershed needs and long range planning that would result in more ecologically sound restoration projects. During this time resource and regulatory agencies were also voicing concern over the lack of appropriate mitigation to compensate for impacts to streams and riparian corridors resulting from road construction.

In an effort to better address mitigation concerns and to provide more of a planning framework in which to identify potential mitigation sites, the NC Department of Environment and Natural Resources developed the NC Wetland Restoration Program

(WRP). Established in 1998, the WRP was established as an in-lieu-fee program within NC DENR whose purpose was to provide compensatory stream and wetland mitigation utilizing a watershed based approach. Although the WRP provided a valuable service to the general public in providing an alternative source of mitigation, it was not equipped to handle the magnitude of mitigation requirements that NC DOT would eventually need. Although the WRP was established to provide both stream and wetland mitigation, it became the primary provider of stream restoration in North Carolina as most small landowners were not equipped to develop and monitor their own stream mitigation projects.

Eventually, in 2001, NCDOT sponsored a one-week Mitigation Process Improvement Workshop that involved stakeholders from all regulatory and resource agencies, including NCDOT and the Federal Highway Administration. Although the stakeholder group expressed many concerns, they identified several fundamental concepts they felt were not being adequately addressed by the current mitigation planning process:

a. There was a need to separate roadway project planning from mitigation such that the imminent need for a permit did not drive the mitigation planning process.

b. The functional replacement of aquatic resources affected due to project construction was desirable.

c. There was a need to adopt a more holistic or watershed perspective when developing compensatory mitigation options. This requires the identification of those factors in a watershed that are affecting aquatic resource health and devote mitigation efforts towards those projects where the biggest benefits are expected.

As a result of this workshop, in July of 2003, the Wilmington District, NC DOT, and NC DENR signed a tri-party MOA that established the Ecosystem Enhancement Program (EEP). The MOA can be viewed at the EEP website at http://www.nceep.net/. Wholly funded by NCDOT, the mission of the EEP is to "restore, enhance, preserve and protect the functions associated with wetlands, streams and riparian areas, including but not limited to those necessary for the restoration, maintenance and protection of water quality and riparian habitats throughout North Carolina." A fundamental concept of this program is that mitigation, if conducted in a watershed planning and analysis framework, will provide mitigation projects that are functionally and ecologically superior to those that are constructed without the benefit of this planning effort. Through this initiative, the EEP is conducting Local Watershed Planning (LWP) efforts in selected high priority watersheds throughout the state. These priority watersheds were initially selected based on the projected needs identified through the 7-year Transportation Improvement Program (TIP) with those watersheds with the highest projected needs selected first. These watersheds are then subject to a more rigorous analysis where subwatersheds (14-digit HUC, see Figure 1) are screened based on existing environmental data including the NC Basinwide Management Plans, presence of 303(d) listed waters, areas where wetlands have been removed from the landscape, storm-water issues, fish and wildlife habitat considerations, and involvement with local resource professionals and stakeholder groups who can provide local knowledge and buy-in to the watershed planning process. The goal of these efforts, through strong stakeholder involvement, is to identify those potential mitigation projects that would provide the maximum benefit to the watershed in which it is located. Currently, there are 22 LWP's under development in North Carolina.

Through this process it has been recognized, especially in urban settings, that non-traditional forms of compensatory mitigation may also need to be examined where traditional stream and wetland restoration opportunities are limited. These include use of Best Management Practices (BMP's) to address water quality and

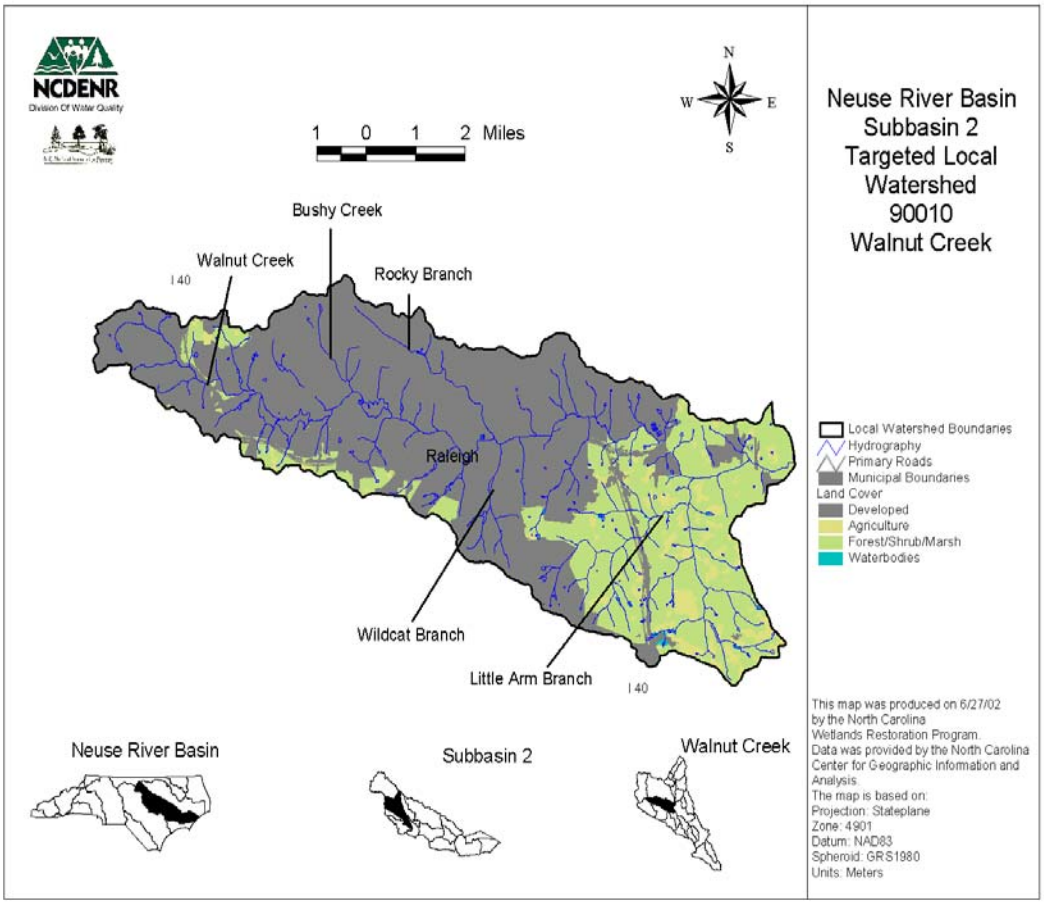

Figure 1 - Example of a Targeted Local Watershed (14 Digit HUC)

quantity concerns, increased use of high quality preservation through partnerships with local and regional land trusts, and the establishment and protection of riparian buffers along existing stream corridors. While the concept of providing mitigation credit for non-traditional forms of mitigation is acceptable, it has not been decided how much credit may be generated for a given project that employs these non-traditional forms of mitigation. One way that this issue may be addressed is through the development of functional assessment methodologies for streams and wetlands that provide a framework to address the loss of aquatic functions associated with highway projects and how these lost functions are replaced with non-traditional forms of mitigation. As of the date of this article, the stream and wetland functional assessment teams, on which the Corps is participating, are working diligently to develop assessment models that are acceptable to all the agencies involved. The purpose of these efforts is to provide a tool to EEP staff that will enable them to identify those aquatic functions associated with particular wetland and stream communities and ensure that those functions are compensated for when mitigation projects are developed.

During the transition period as EEP is developed, it has purchased or otherwise protected, through conservation easements, over 19,500 acres of high quality properties that contain a variety of upland and aquatic habitats including approximately 9,500 acres of riparian buffer and wetlands. Figure 2 is an example of one of the high quality properties that have been acquired and preserved. These properties are protected with conservation easements and may be held in perpetuity by an appropriate land trust or may be turned over to the North Carolina Wildlife Resources Commission for long-term management. The successful identification and acquisition of these properties relied heavily on partnerships with local and regional land trusts.

To provide the necessary coordination with the resource and regulatory agencies, the MOA established the Program Assessment and Consistency Group (PACG) that is composed of resource and regulatory agencies. The purpose of the PACG is to provide guidance and direction to the EEP to ensure that this program is satisfying agency mitigation expectations. Because the agencies are not involved in a detailed review of individual mitigation plans, it is critical that the EEP is fully "transparent" such that the agencies are aware of current mitigation projects and how those projects are performing. Currently, the PACG meets monthly with EEP staff to discuss current issues and to inspect a subset of mitigation projects to satisfy this requirement. It should be noted that these mitigation projects are still subject to specific success criteria and that as they are To provide the necessary coordination with the resource and regulatory agencies, the MOA established the Program Assessment and Consistency Group (PACG) that is composed of resource and regulatory agencies. The purpose of the PACG is to provide guidance and direction to the EEP to ensure that this program is satisfying agency mitigation expectations. Because the agencies are not involved in a detailed review of individual mitigation plans, it is critical that the EEP is fully "transparent" such that the agencies are aware of current mitigation projects and how those projects are performing. Currently, the PACG meets monthly with EEP staff to discuss current issues and to inspect a subset of mitigation projects to satisfy this requirement. It should be noted that these mitigation projects are still subject to specific success criteria and that as they are constructed, are subject to annual monitoring for a period of at least five years to ensure that the success criteria continue to be met.

Based on existing sources of information including soils maps, NWI maps, air photos, etc., NCDOT has estimated that it will need in excess of 1,000,000 linear feet of stream mitigation and in

Figure 2- Example of High Quality Aquatic Resource Protected under EEP (on EEP webpage)

excess of 5,000 acres of wetland mitigation to satisfy its 7 year TIP. As highway projects are moved through the planning process, it is expected that these mitigation needs will decrease as jurisdictional areas are more accurately mapped prior to permit application. As it is not possible to predict the private need for mitigation, the existing In-Lieu-Fee program, which is part of the EEP, will continue to allow a year for the mitigation requirement to be satisfied after the applicant makes payment into the fund. With respect to restoration and enhancement projects, the EEP is currently requesting proposals for stream and wetland restoration projects in high priority watersheds with implementation of the first of these projects to occur in the spring and summer of 2005.

Fundamentally, it is the goal of the EEP to provide fully successful and functioning compensatory mitigation on a programmatic scale in advance of construction related impacts. This is being achieved by EEP planning and developing mitigation projects, based on projected impacts from NCDOT's TIP, years in advance of actual road construction. It is expected that the EEP, through its watershed and planned programmatic approach to compensatory mitigation, aquatic resource losses resulting from transportation construction projects will be fully compensated. Although the EEP is still in the Transition Phase, it is expected that this unique approach to up-front compensatory mitigation will result in less delays in the construction of highway projects that were formerly associated with mitigation plan development and review on a permit-by-permit basis.

(Scott McLendon is Chief of the Asheville Regulatory Field Office for the Wilmington District and has been involved in mitigation issues with the NCDOT and the private sector for many years.)

Watershed Approach using GIS in the state of Arkansas

Kyle Green

As project managers for the U.S. Army Corps of Engineers (Corps) Regulatory Branch, many of us have witnessed the gradual integration of geographic information systems (GIS) into our everyday work tasks and the important role that it plays in numerous aspects of the Regulatory Program. As time passes, we realize that GIS has enabled us to make better and more timely decisions on permit actions and other work-related duties. GIS allows the Regulatory Branch to achieve various tasks that include, but are not limited to: combining all available resources on one source (topographic maps, aerial photographs, floodplain maps, historic sites, threatened and endangered species, etc.) to aid in the evaluation process of Section 404/10 permit actions; tracking impact and mitigation locations associated with various Section 404/10 permit actions for for watershed level cumulative impact assessments; and to provide reliable and accurate geographic information associated with Section 404/10 permit actions. Figure 1 overlays permitted impacts, mitigation sites, preserves, endangered species information, etc., in a GIS, which could be utilized by the various Corps regulatory programs to identify location information for Section 404/10 impacts and/or mitigation (and watersheds they occur in) that will allow for better decision-making by project managers during the evaluation of permit actions. Information pertaining to threatened and endangered species and cultural resources provided through GIS will allow project managers to identify and work toward avoidance and minimization of impacts to threatened or endangered species or cultural resources associated with permit actions.

In recent years, tracking stream/wetland impacts and mitigation through GIS has become a very important tool for the Little Rock District Regulatory Branch as well as many other Corps Regulatory Branches. This approach was shared by the three Corps districts regulatory Programs (Memphis, Vicksburg, and Little Rock) within the state of Arkansas with the Arkansas Soil and Water Conservation Commission (SWCC). In 2001, the Arkansas SWCC developed a plan to create and implement an overall database that will include stream/wetland impact and mitigation information associated with COE permits within the state of Arkansas. The SWCC has coordinated with the three Corps Districts within the state to receive stream/wetland impact and mitigation information from each district at regular intervals. The stream/wetland impact and mitigation information provided includes the Corps action ID, issuance date of Corps permit, Corps District name, linear feet/acreage of impact and mitigation for stream(s)/wetland(s), type of ecological system impacted and mitigated for stream(s)/wetland(s), 8-digit Hydrologic Unit Code (HUC code) for impact and mitigation site(s), impact and mitigation site geographic information (lat.-long., section, township, range), and mitigation method (e.g. creation, restoration, etc.). In addition to this information, the SWCC will compile available historical information for the database, including land use and development, population trends, public and private restoration and easement programs, streambank and riparian zone restoration, state and federal management practices on public lands, unauthorized and unregulated activities, water quality degradation, and other watershed specific activities available at individual agencies and organizations.

All of the information available in the database will be made accessible to users through a web-based, "user-friendly" GIS interface termed the "Arkansas Wetland Resource Information Management System" (AWRIMS) that compiles and delivers the information to the user via standard Internet browser and connection. The website allows visualization of impact and mitigation information along with other available information for any geographic area in the state of Arkansas specified by the user. Multiple geo-spatial data can be overlain and compared through map viewers on the AWRIMS website. From the map viewers, the user can choose which data to overlay and view. The only limitation on map viewing is data availability and accessibility. The Center for Advanced Spatial Technology (CAST), part of the University of Arkansas system, has developed computer code that allows access to GeoStor,the state's primary digital data repository, and delivery of image data to remote locations (personal computers) in a matter of seconds. The computer code for this type of interactive website has only recently become available in commercial software. Real-time upload via the Internet of individual data sets on GeoStor is currently being developed. This new capa-

bility provides a solution to the long-term problem of maintaining current and "up-to-date" information on the website. GIS software is not necessary to access the website. Anyone using the common Internet web browser can create maps and view data for their watershed of interest. Benefits to the public and the environment will be realized through expansion of this new decision-support and information management system. The SWCC has compiled the Corps permit information from the three districts in a database along with the various other resource information that will be displayed in GIS on the AWRIMS website. Currently the SWCC is working with CAST on the layout and implementation of the AWRIMS website. The SWCC will receive regular updates of Corps permit information from the three districts in order to maintain an up-to-date database for the AWRIMS website. The role of the Corps in the development of the AWRIMS website is limited to the task of providing information associated with Section 404/10 permit actions, including impact and mitigation data.

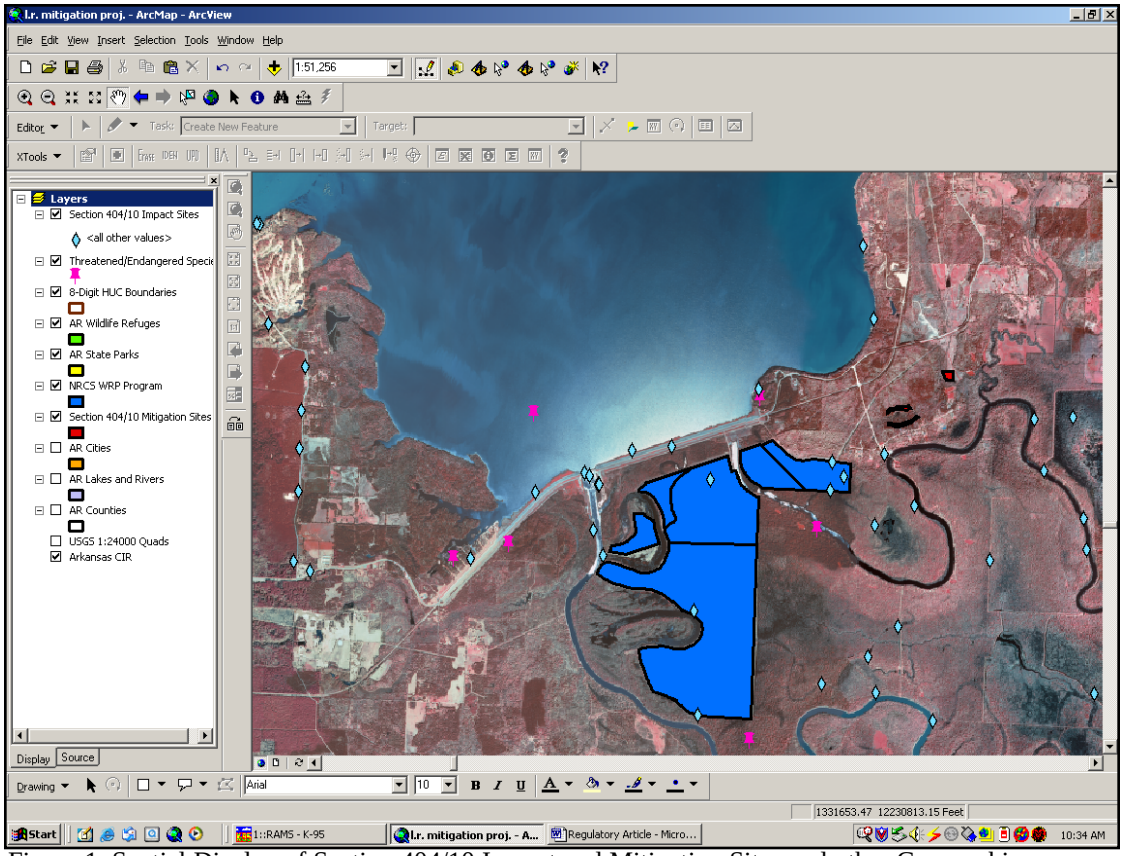

Figure 1. Spatial Display of Section 404/10 Impact and Mitigation Sites and other Geographic Information Using AWRIMS.

Through the development of the database and creation of a GIS interface to present the various information, government agencies, private organizations, individuals, etc. will be able to see the "big picture" of what activities and interests lie within a particular watershed. With this knowledge, users (Corps regulators, planners and developers, Federal and State resource agencies, private landowners, etc.) will be able to inventory and characterize watershed conditions and identify and prioritize aquatic resources needs, whether as part of developing an approved watershed management plan or simply producing inventories of resource needs. The information will help agencies to develop management plans for watershed and pinpoint how the plans can be implemented. Such information will also inform and improve on permit decisions. A watershed approach has and will continue to play an important role in the quest to balance the interests of both economics and environment within the state of Arkansas. The watershed approach along with GIS utilization will allow the Corps regulatory programs to determine at what level cumulative impacts are occurring to waters of the United States within each individual watershed and determine what steps should be taken for avoidance, minimization, and compensation-mitigation on permit actions within each watershed. The development and implementation of the database and GIS interface by ASWCC should make the watershed approach in the state of Arkansas a more simple and complete process.

For more information regarding this topic, please contact Mr. Kyle J. Green with the Little Rock District COE Regulatory Branch at (501) 324-5295 or e-mail at kyle.j.green@usace.army.mil.

(Kyle Green is a project manager in the Little Rock Regulatory Branch. Duties include Section 404/10 permit evaluation and GIS/Information Technology Support for the Regulatory Branch.)

Also of Interest

Changes to HQ. Changes at Headquarters. We would like to thank Joanne Barry (New England District) for all her hard work, particularly on the Mitigation Action Plan, during her time at HQ on development assignment. In the near future, we will be advertising up to 3 development positions beginning January 2005. One of the positions will be on the Regulatory CoP (Community of Practice) and the second will likely be assigned to one of the RITs (Regional Integration Teams). The third position, open to experienced Section and Branch Chiefs, will be located at the Office of the Assistant Secretary for Civil Works in the Pentagon. This position will deal with numerous complex Civil Works issues, including Regulatory, Tribal Issues and the Everglades *(POC: Mark Sudol)*.

Update on the 87 Manual. The drafts of both the Alaska and Arid West manuals continues to progress and meetings are scheduled for both documents before the end of this calendar year. The National Technical Review Team has had one teleconference call and decided that the next two manuals will be the southeastern coastal plain and the northeastern U.S. Districts in these areas should anticipate upcoming requests for: technical plant, hydrology and soil problems; known studies on technical issues; atypical and problem areas that need to be addressed and any other technical issues that should be addressed by regional manuals.
(Katherine Trott)

Wetland Digital Information. There is extensive digital wetland mapping information available on the US Fish and Wildlife Service Wetlands Mapper website. This may be helpful for NWI type data and the information can be found at http://wetlandsfws.er.usgs.gov/
(Bob Lichvar)

Update on the Federal Interagency Mitigation Action Plan (MAP). The MAP team continues to work on guidance to address the use of buffers and riparian areas and preservation in compensatory mitigation plans. The team is also developing a guidance document on "Difficult to Replace" wetlands. These draft documents were discussed at the recent Stakeholder Forum held in Tampa September 20-22, 2004. Headquarters and IWR staff participated in this forum to listen to views on these documents and upcoming matters to be addressed by the MAP. A technical resource document to assist in developing stream mitigation has been completed. This document entitled Physical Stream Assessment: A Review of Selected Protocols for use in the Clean Water Act (CWA) Section 404 Program (Stream Mitigation Compendium) is available on the MAP website at http://www.mitigationactionplan.gov/stream%20comp%20page.htm.
(Meg Smith)

Fourth Stakeholder Forum on Federal Wetlands Mitigation, September 2004. The Stakeholder Forum was faciliated by the Environmental Law Institute for the Federal Interagency Mitigation Action Plan team last month in Tampa, Florida. The Forum's webpage is now active at: http://www.eli.org/research/wetlandsmitigationforum2004.htm. The page includes links to PowerPoint presentations, audio recordings, photos, and other related websites and materials. Fieldtrip details and final forum report will be accessible via the website soon.

Newsletter Communication

To comment on the newsletter, suggest topics, submit an article, or suggest events or articles of interest, please contact Bob Brumbaugh at:

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